

Chapter 2

After the Gulf War: Balancing Space Power's Development

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It is a military axiom to “take the high ground”—and space is the ultimate high ground. In the Gulf War, US space forces were virtually unopposed, but in the future that may not be the case. . . . Without question, it was fortunate that there were six months to get ready. The next time, that luxury may not exist, and we must be prepared. . . . The first need is a key element—development of space doctrine to provide guidance and direction at all levels of war, across the full spectrum of conflict.

—Lt Col Steven J. Brugger

Early military applications of space-based assets bore little resemblance to their successful use in “the first information war.”¹ The United States developed most of its early space systems to serve the cold war nuclear deterrence strategy. The need to protect space sources and methods resulted in a high degree of secrecy and organizational compartmentalization. As a result, when Operation Desert Shield began, the highly fragmented leadership of the space community lacked coherent doctrine, operated with an inherited top-down “technology push” for system requirements, and had little space power experience.²

Space power was simply unprepared to support the theater commander in chief (CINC) in other than the cold war strategic role.³

The experiences of the Gulf War confirmed these characteristics—the majority of the documented lessons concerned

This work was accomplished in partial fulfillment of the master's degree requirements of the School of Advanced Airpower Studies, Air University, Maxwell AFB, Ala., 1996.

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a lack of doctrine or a lack of space literacy or experience. In the development of space power, doctrine and experience have evolved much more slowly than the pace of technology. In the interim, have the US participants redressed the imbalance that existed in the development of space power as witnessed in Operation Desert Shield/Storm? At issue for space policy makers is the question of whether or not reforms in technology, experience, or doctrine will move the US military space program toward a more robust war-fighting capability.

From its meager beginnings in the Vietnam conflict, space power evolved dramatically. In Vietnam the military used space-based platforms primarily for weather forecasting, navigation assistance, and communications support. During Operation Urgent Fury in Grenada, US forces used the Fleet Satellite Communications (FLTSAT) and Leased Satellite Communications (LEASAT) Systems in a command and control role for the first time in a joint operation. Operation El Dorado Canyon in Libya and Operation Just Cause in Panama were the first major operations in which US forces used information from space-based national intelligence systems.⁴ In addition, Operation El Dorado Canyon was the first operation in which a space system developed as a Tactical Exploitation of National Capabilities Program (TENCAP) project was used.⁵

United States war fighters were not able to use the full array of civil, military, commercial, and national intelligence satellites until the Gulf War. Space-based assets carried over 80 percent of all messages to and from the US Central Command's (USCENTCOM) area of responsibility (AOR). Satellite intelligence data was essential for planning the air campaign, critical for early warning of surface-to-surface missile system (Scud) ballistic missile attacks, and aided in determining enemy positions and activities.⁶ For the first time in any military campaign, Global Positioning System (GPS) satellites provided precise position information essential for navigation over an almost featureless desert terrain. Arguably, space "came of age" for war fighters in the Gulf War, but the situation was far from perfect.

US Space Command (USSPACECOM) traced some of the most significant problems from the Gulf War to a core is-

sue—normalizing space operations for theater operators.⁷ For example, since very little basic and operational doctrine existed, space preplanning for wartime situations lagged well behind space technology. Because USCENTCOM had not articulated how space power ought to be used in its AOR and USSPACECOM was not fully prepared to provide “normalized” support, US military forces were largely uninformed and unprepared for using space power when Operation Desert Shield began. The normalization of space operations for theater operations was still not complete as of 1995. Space power doctrine and experience are still significantly lagging behind space technology. All three of these threads of development—technology, doctrine, and literacy/experience—are crucial, but the lack of balance is particularly important because it points to the focus of what should be the next phase of development in military space policy.

A definitive guide to the future focus of space power development requires sophisticated cost-effectiveness and operational analysis. However, it is possible to make a useful, qualitative analysis based on recent experience and general assumptions about the relative costs and leverage of reforms. Are funds better spent on acquiring technology, improving experience, or developing doctrine? Which solution offers more leverage for the future?

After the Gulf War, the Air Force, Army, and Navy moved quickly to provide better space power support to the war fighters. Senior Air Force leadership founded the space numbered Air Force (Fourteenth Air Force), activated the AF Space Warfare Center (SWC), and established space support teams (SST). Following the Air Force lead, the Army and Navy established their own space support teams. In general, USSPACECOM, all service components, and the national intelligence agencies attempted to provide better support to the combatant commands and more efficient preplanning of existing space forces.⁸

Fourteenth Air Force is now responsible for war planning, readiness, and execution while serving as the Air Force war-fighting component to USSPACECOM.⁹ The Air Force activated the SWC to refine doctrine, develop tactics, formulate con-

cepts, and demonstrate systems and technologies that improve military operations and the employment of space forces in warfare. Finally, all service components, USSPACECOM, and intelligence organizations currently deploy space support teams to help conduct integrated space operations for the theater CINC.

In contrast to the significant reorganization of space forces, doctrinal changes were less dramatic. At the time of this writing, Air Force Doctrine Document (AFDD) 4, "Space Operations Doctrine" is still in coordination and may be approved in 1995. Arguably the most important doctrinal manual, Joint Doctrine, Tactics, Techniques, and Procedures (JDTTP) 3-14, *Space Operations*, was in coordination prior to the Gulf War and is still at least a year away from closure.¹⁰ The space support teams mentioned above are available to deploy and support the war fighter; however, joint doctrine is still not available to guide their actions four years after the end of "the first information war."¹¹ Indeed doctrine lags, suggesting important near-term focus for policy. The thesis of this study is that a lack of space power doctrine and experience caused the majority of the space-related problems in the Gulf War. Further, while the space community has made efforts to normalize space operations since the war, the lack of doctrine and experience is still the major impediment to effective war fighting today and for future conflicts.

Focus

This study focuses on basic and operational Air Force and joint space doctrine which was available to the principal space participants (USCENTCOM and USSPACECOM) before, to, and during the Gulf War, including operation plans (OPLAN). Equally important, this study relies largely on the unclassified portions of the after action reports from these two unified commands, the Joint Chiefs of Staff Joint Universal Lessons Learned System (JULLS), the *Gulf War Airpower Survey* (GWAPS) and the *Conduct of the Persian Gulf War: Final Report to Congress* (CPGW). When possible, these documents were verified with primary sources.

Assumptions

The Gulf War validated the operational worth of space systems. Space-based communications, weather, navigation, reconnaissance, and intelligence offered the war fighter capabilities unparalleled in earlier conflicts. The Gulf War provided a glimpse of how space control in the next century could be as crucial as air and sea control have been in this century.

In the next century, space will contribute significantly to national economic, political, and security objectives. National, civil, and commercial space agencies have a need to develop space systems in a complementary, not competitive process. Within the Department of Defense (DOD), cooperation is essential so that the information received from space assets continues to benefit war fighters. Outside the DOD, trust, space power literacy, and cooperation are critical to ensure efficient use of all space systems. The impact of space power for the future makes the thesis of this study all the more important.

Methodology

This study uses an inductive examination of evidence to support the author's thesis. The following section illustrates the USCENTCOM and USSPACECOM space lessons from the Gulf War and generalizes these experiences into three threads of development: technology, experience, and doctrine. From that perspective, a description of the efforts to solve the problems from the war is offered. Subsequent to that, observations from this study lead naturally to future implications.

Establishing the Framework: Lessons from the Gulf War

History, whatever its value in educating judgment, teaches no 'lessons'. . . . Alternatively one might argue that a given conflict teaches many lessons: unfortunately, most of them are wrong.

—Sir Michael Howard

This section establishes a framework for analysis by organizing the lessons from after action reports, the *GWAPS*, the *CPGW: Final Report to Congress*, and other nonofficial works into three broad categories of space power development: technology, experience, and doctrine.¹² A lesson requiring the acquisition of new technology to resolve the issue is included in the technology thread. A lesson leading to or requiring the accumulation of new knowledge, literacy, skill, or reorientation is organized in the experience thread. For example, airpower strategists learned from World War II experience that the first requirement for nearly all military operations was air superiority. Finally, a problem indicating a lack of a codified, sanctioned body of propositions to guide how space power ought to be used is attributed to a lack of doctrine. For the purposes of this study, doctrine includes not only formal, published doctrine, but also directives, manuals, and other official published guidance.

These common threads of the development paradigm are not foolproof; they offer a simple framework for analysis and a point of departure for future investigations. Using this three-part framework, it quickly becomes obvious that the majority of the space power problems encountered during the Gulf War can be attributed to a lack of doctrine and experience. Unfortunately, the development of US space technology continues to outpace both doctrine and experience.

US Space Command After-Action Report

“Normalizing space support for the war fighters” is the common theme echoed by the authors of USSPACECOM’s after-action report.¹³ The writers of this report made an obvious effort to address the importance of establishing and updating detailed space annexes (annex N) in the war-fighting CINC’s operation plans. Table 5 illustrates the lessons from the viewpoint of USSPACECOM and the corresponding category in the space power development process.

More preplanning is required; the supported CINC’s OPLANs need work; and communication requirements should be included in OPLANs. Space annexes to OPLANs either did not exist or were underdeveloped before the Gulf War. Prior to

Table 5
USSPACECOM Lessons

Lesson	Category
More preplanning required—May not have six months of buildup for the next war.	Doctrine
Supported CINC OPLANs need work.	Doctrine
Include communication requirements in OPLANs.	Doctrine
Normalize all space support.	Doctrine and Experience
Normalize tactical warning support.	Experience and Technology
Operational control of military satellite communication systems remains fragmented.	Doctrine and Experience
Maintain the US multispectral imagery capability.	Experience

Source: USSPACECOM After Action Report, 31 January 1992.

Operation Desert Shield, US Central Command's OPLAN did not address how space power would be used in the AOR.¹⁴ In remarks to the Eighth National Space Symposium in April 1992, Lt Gen Thomas S. Moorman Jr., the vice commander of Air Force Space Command during the Gulf War, confirmed this fact. He commented that if the US military learned anything from the Desert Storm example it was that preplanning is essential. "The best example of the lack of planning that we had is that General Horner went to war without a space annex—he did not have in his US Air Forces, Central Command (CENTAF) operations plan a space annex."¹⁵ As a result of the lack of preplanning, weather vans, ground antennas, intelligence terminals, and other space-related ground equipment were omitted from the time-phased force and deployment list (TPFDL).¹⁶ Inadequate preplanning is a theme common to all the reports analyzed for this study.

Forces should normalize all space support and tactical warning support. USSPACECOM did not fully realize or plan for the important role space power would play in missions other than strategic ones. By normalizing space support at the theater level,

USSPACECOM envisions operating its space systems as the Air Force operates its aircraft on a day-to-day basis. Through the documentation of these lessons, the authors not only highlighted the value of normalizing space support to the theater war fighter, they also ensured readers would understand the significance of theater ballistic missile warning for the future. Gen Charles A. Horner, who had the unique experience of being the joint forces air component commander during the Gulf War and CINC USSPACECOM after the war, declared that the number one lesson of the Gulf War was that the US must develop a ballistic missile defense system capable of directly supporting the requirements of deployed forces as well as North America.¹⁷ Normalizing space operations mandates the development of doctrine so that forces may organize, train, and equip to prepare for future wars.

Operational control of military satellite communication systems remains fragmented. Participants experienced the frustrations caused by a lack of centralized control of space communication systems. While USCINCSpace is given combatant command (COCOM) by the chairman of the Joint Chiefs of Staff, no formal relationship exists between USSPACECOM and the managers of the several military satellite communication systems.¹⁸ The operational control of these satellite systems remains fragmented among the various space agencies, services, and commands. This experience highlights the need for a centralized satellite communication structure in peacetime and war.¹⁹

The United States must decide whether to maintain its only multispectral imagery (MSI) capability, the aging LANDSAT, or to continue to rely on other nations for MSI support.²⁰ MSI proved to be beneficial by providing US and Coalition forces the opportunity to better understand and react to changes in the battlefield terrain. It will also offer future war fighters the ability to rehearse their missions, determine optimum tactics, and identify major threat lanes or attack axes to more effectively exploit training and technology in combat.²¹ Finally, if the US Commerce Department continues to control LANDSAT on a day-to-day basis, agreements must be maintained to allow for peacetime military training and wartime control.

While this lesson covers all three threads of the development process, experience is the core issue.

USCENTCOM After Action Report

The war fighter's perspective was somewhat different than USSPACECOM's perspective. US Central Command developed five hundred JULLS after the war.²² While USSPACECOM emphasized normalizing space operations, the supported command accented the need for better doctrine, training, and support from the experts. Table 6 is a compilation of the USCENTCOM lessons and the corresponding thread of space power's development process. The lessons highlighted are not the only USCENTCOM lessons related to space operations; however, at the unclassified level they represent the vast majority of the space power problems discovered by USCENTCOM during the Gulf War.²³

US forces need better preplanning for space support doctrine on the use of ground mobile force (GMF) terminals. After the war, USCENTCOM planners were acutely aware of how little useful space power doctrine existed. Space power doctrine was either nonexistent or inadequate for the Gulf War. Through innovation and ingenuity during the six-month buildup of Operation Desert Shield, many forces made space power work. However, a six-month buffer is a luxury the United States may not have in future conflicts.²⁴ In addition, as the Gulf War developed and grew, military forces needed more GMF satellite communication terminals than doctrine prescribed and the TPFDL provided. The VII and XVIII Corps experienced shortages as a result.²⁵

USSPACECOM needs a liaison to CINCs. The Space Demonstration Program and National Military Intelligence Support Team (NMIST) are critical for timely battle damage assessment (BDA). These lessons provided the impetus for the postwar SST concept.²⁶ Based on the Gulf War, USCENTCOM planners realized they did not have the expertise to effectively use space power. Their solution was to import the knowledge from the different space sectors for peacetime exercises and to continue having experts provide operational demonstrations of the capabilities provided by space power.²⁷

Table 6
USCENTCOM Lessons

JULL	Category
Better preplanning required for effective space support.	Doctrine
Doctrine required on the use of ground mobile force terminals.	Doctrine
USSPACECOM liaison to CINCs required.	Experience
Space Demonstration Program.	Experience
NMIST critical for timely battle damage assessment.	Experience
Centralized control of theater communications must be exercised.	Experience
Space launch responsiveness.	Technology

Source: USCENTCOM After Action Report, 15 July 1991.

Forces need centralized control of communications. Because of the many sectors involved with satellite communications, initial control was, at best, fragmented.²⁸ Early in Operation Desert Shield, US Central Command assumed control of the validation process for all long-haul strategic communications. Without centralized control, early deploying units might have used all available resources before hostilities began.²⁹ Unity of command in allocating the limited resources, satellite capacity, and frequency spectrum, in particular, was vital to subsequent unit deployments.³⁰ The Gulf War validated the importance of exercising centralized control of theater communications.

USSPACECOM did not have a booster to meet a CENTAF request to accelerate the launch of the next Defense Satellite Communications System (DSCS) satellite.³¹ The DSCS satellite would have improved USCENTCOM's overly taxed communications capability significantly. The inability of the United States to launch satellites in a short period of time is a serious weakness.

Gulf War Airpower Survey

The *GWAPS* authors focused on describing the “space product” and its operational impact. Even though the classified space power research by the GWAPS personnel is much more detailed, the unclassified report used here tells a story consistent with that of the classified reports. This unclassified report addressed five central themes.

Planning and Training for the Use of Space Systems. In the areas where space capabilities were not fully integrated with doctrine and tactics (e.g., BDA and other intelligence functions), the importance of the five and one-half months of Desert Shield preparation cannot be overemphasized.³² While some annexes to USCENTCOM’s Operation Plan 1002 were ample, weaknesses or omissions in other areas were inadequate for training or real-world events.

In the cases where adequate doctrine existed, space power was used effectively. In cases where doctrine did not exist or was inadequate, the results of space operations reflected the absence of in-depth preplanning.³³

Space Mobilization. The time to mobilize space power varied across the board. In some cases, the equipment was immediately available due to peacetime requirements (e.g., F-16s equipped with GPS receivers). In other cases, the time to mobilize depended on preplanning, launch variables, and the availability of trained personnel.³⁴ If any one of these variables was deficient, there was a corresponding deficiency in mobilization.

Military Utility Space Systems. The contribution of space power was evident in terms of concrete war-fighting results. In some cases, however, desired results could only be achieved by crossing functional boundaries. For example, the detection of Scuds by the Defense Support Program (DSP) constellation required action from several of the Coalition forces to destroy these mobile targets. The lesson here is that doctrine must provide the flexibility to cross functional boundaries.

Command and Control of Space Systems. The highly classified, strategic focus of the US military space community was not suitable for the tactical environment of the Gulf War. The

cold war mentality of the space community oriented its support to strategic customers prior to the war (e.g., National Command Authorities [NCA] and various intelligence agencies). Complicating this predicament, many of the key intelligence-related assets were not controlled by the war-fighting commander.³⁵

After Operation Desert Storm, the space community realized wars in the future will likely require theater-level support from space forces. This lesson also implies that centralized control of space systems by the war-fighting commander is preferred over other arrangements.

The Role of Commercial Space Systems and Receiver Equipment. Commercial space systems played a significant role augmenting the military Coalition forces. In addition, the Coalition members cooperated to deny Iraq access to satellite imagery from France's commercial *Système Probatoire pour l'observation de la Terre* (SPOT).³⁶ Military forces not only experienced the value of using commercial satellite systems, they now better understand the value of denying the enemy's use of commercial satellite systems.

Conduct of the Persian Gulf War: Final Report to Congress

As expected, the writers of the *CPGW* described the lessons and observations from the war in a much broader context than the sources previously cited.³⁷ They were also more interested in describing weapons and technology than operational concepts. Table 7 illustrates the space-related shortcomings and issues from volume II, appendix K, of the report.

The United States does not have a reactive space-launch capability. This observation is a common theme addressed by the majority of the studies referenced for this chapter. US space launch, responsive or otherwise, continues to be a national problem.

Tactical warning capabilities must be improved. While USSPACECOM emphasized the lack of experience and the need for doctrine in this area, the writers of the *CPGW* illustrated the need for improved technology to solve the tactical ballistic missile warning problem. Specifically, they believe that in the future, an improved sensor to replace the DSP is appropriate.³⁸

Table 7
Persian Gulf War Space Power
Shortcomings and Issues

Shortcoming/Issue	Category
The United States does not have a reactive space-launch capability.	Technology
Tactical warning capabilities must be improved.	Technology
GPS and most satellite communication (SATCOM) are vulnerable to exploitation.	Experience
The aging LANDSAT system under Commerce Department control must be replaced.	Experience and Technology
DSCS connectivity remained fragile due to age and condition of satellites and ground stations.	Experience and Technology
For future operations, planners must consider the challenges of operating within another nation's command, control, communications (C ³) infrastructure.	Doctrine and Technology
Military doctrine and training must institutionalize space-based support to operational and tactical commanders and incorporate it into operational plans.	Doctrine

Source: CPGW Final Report to Congress, Vol. 2, April 1992.

GPS and most satellite communications are vulnerable to exploitation. The Gulf War confirmed the need for the production, distribution, and integration of GPS receivers incorporating selective availability decryption. The Gulf War experience also proved the value of fielding the Military Strategic and Tactical Relay (MILSTAR) satellite system and installing anti-jam modems for super high frequency (SHF) fixed-base satellite terminals and tactical ground mobile terminals.³⁹

The aging LANDSAT system under Commerce Department control must be replaced. The writers of the CPGW and USSPACECOM's after action report agree on this issue. The Gulf War experience validated the importance of maintaining an MSI capability available for military use.

DSCS connectivity remained fragile due to age and condition of satellites and ground stations. In the opinion of these authors, the older DSCS satellites and ground terminals require modernization. The experience from the war warrants an increase in the number of military satellites providing worldwide command and control coverage. In addition, procurement of smaller more mobile ground terminals, similar to a prototype used by the XVIII Airborne Corps, is needed to aid in transport to and within the theater.⁴⁰

For future operations, planners must consider the challenges of operating within another nation's C³ infrastructure, and military doctrine and training must represent institutionalized space-based support to operational and tactical commanders and be incorporated into operational plans. The last two issues from the *CPGW* are similar to previous lessons from USSPACECOM and the *GWAPS*.

Status of the Lessons

USSPACECOM and US Central Command are the only two sources discussed with any type of formal approach to tracking the lessons of the Gulf War. However, either through omission or by design, none of the space power lessons from the Gulf War are actively monitored by either of the unified commands today.⁴¹

After the Gulf War, USSPACECOM initiated action on many issues attributed to the Gulf War, even though they did not actively monitor the status of any of their lessons through a formal process. While issues such as space support teams and better OPLANs received considerable attention and each lesson was assigned a point of contact (POC), no agency was assigned the responsibility for resolving the fate of those lessons. Because of this, it is difficult to determine with confidence which Gulf War experiences USSPACECOM considered lessons for the future and which experiences were discarded after some scrutiny. Without question the USSPACECOM lessons did receive some level of hearing immediately after the war. USSPACECOM initially disseminated 97 copies of its report to 13 agencies including all war-fighting CINCs.⁴² While there was wide distribution of the lessons, the

point is that no mechanism existed to either discard a lesson as an anomaly, develop a solution, or elevate the problem to the Joint Chiefs of Staff for resolution.

In contrast, US Central Command inserted its lessons from the war into the JULLS. This process required the command to evaluate the five hundred lessons from the war and recommend what action should be taken for each. The recommendations ranged from designation as a noted item to flagging a lesson as a remedial action project (RAP) requiring periodic monitoring until resolved.⁴³ However, after the space power lessons were routed through the JULLS process, none were designated remedial action projects.⁴⁴ This does not mean the space-related lessons were not considered important, only that other processes or programs may already incorporate a solution to those problems. The lessons from USCENTCOM received much wider dissemination due to their inclusion in the JULLS database. While neither of the principal unified commands during the Gulf War currently monitors its respective lessons for resolution, USCENTCOM's lessons were adjudicated through a formal process.

Synthesis of the Lessons

In the development of space power, it is apparent from the studies examined that technology continues to surpass the progress of doctrine and experience. Arguably, the majority of lessons examined here were related to a lack of doctrine or a lack of experience (80 percent). The imbalance between space technology, doctrine, and experience is not a new phenomenon, but it is commonly overlooked.

Gen Charles A. Horner synthesized the most important space power problems from his unique perspective as the joint force air component commander during the war and as commander in chief of USSPACECOM after the war. The first major problem he noted was the lack of experience US forces had in using space assets, especially with respect to intelligence systems.⁴⁵ US forces simply were not familiar with using information obtained from satellite constellations like the DSP and GPS. The second significant problem General Horner noted was the overclassification of space information.⁴⁶ The classifi-

cation of satellite products initially undermined the relationship between the United States and the Coalition forces and was a major impediment in getting information to the war fighters. In General Horner's opinion, the way to resolve these problems is to shed the cold war strategic heritage of space and to tear down the walls of classification the space intelligence community has built around itself.⁴⁷

In a separate work, Mackubin Thomas Owens reviewed a number of Gulf War studies and distilled all of the lessons to three principles. "On first examination, these principles might seem so broad as to be trivial. Yet our lack of success in Vietnam demonstrates that we have not always paid as much attention to these principles as we should have. These lessons can be summarized as follows: people and organization matter; technology matters; and ideas (doctrine) matter."⁴⁸

Technology, experience, and doctrine do matter. To maximize the potential of space power for future conflicts, it is evident from the material presented here that the United States needs to reassess the level of effort placed in developing space power doctrine and experience. Unfortunately, the inclination to be on the leading edge of technology often comes with a mutually strong penchant to disregard the teachings of the past.⁴⁹ The next section describes the efforts made since the war to improve these three developmental threads.

After the Gulf War—Uneven Improvement

The Air Force has a well understood, war-tested military doctrine for air power. The crux of the problem is Air Force insistence that the same doctrine applies to space.

—Kenneth A. Myers

It seems that the majority of the space power problems encountered during the Gulf War resulted from a lack of space power doctrine and experience. Since the Gulf War, the development of space power remains uneven—doctrine and experi-

ence continue to trail behind technology. While the search for superior systems is required, until space doctrine is on an even plane with the emerging technology, the employment of space power will not be optimized.

Space operation plans have improved; however, joint space doctrine remains unpublished. For example, while various SSTs are training regularly with war fighters, no joint doctrine exists to guide them on command relationships or how the space portion of the next war ought to be waged. Finally, new organizations designed to educate, train, and support the war fighters are making headway to normalize space operations. The US military is making progress in all three threads of space power development, but at uneven rates of advance, with technology clearly in the lead—a circumstance due in part to the legacy of space power.

Space Power's Legacy

The genesis of the American military space community's focus on research and development (R&D), vice operational support, began in response to the Soviet launch of sputnik in 1957. Following this event, the United States quickly became the world's leader in space power. However, the United States linked most military space development to support cold war nuclear deterrent strategies. High strategic stakes caused tight security and aggressive technological development. Space became a highly classified technology-oriented operation, characterized by restricted access to information about satellite capabilities that created impediments to supporting political and economic leadership in the United States.⁵⁰ This approach may have been appropriate for the cold war; however, Operation Desert Storm and a different world environment indicated a change was in order. Changing this mentality has not come easily, nor is the process close to completion. In a major study after the Gulf War, commonly referred to as "The Wilkening Report," distinguished authors advised Dan Quayle, then the vice president, of this reality.⁵¹ They warned that the cold war security requirements continued to contribute to the inefficiencies in the conduct of the nation's space program.⁵² The origin of space power in the

United States established a pattern of development that has proven difficult to overcome.

The experience of space operators has also varied. In the early years, many aviators with extensive flying experience in World War II and Korea were the core space operators. This changed in the mid-1960s when the requirements of the Vietnam War stripped the space community of its flyers and hence its operational focus.⁵³ Since then, the highly classified space program developed the reputation for breeding a R&D vice operational mentality that has been difficult to overcome.

The Gulf War was a turning point in revitalizing the operational focus for space power. In addition, to infuse more operational thinking into the space community, the Air Force merged intercontinental ballistic missile (ICBM) operators into Air Force Space Command.⁵⁴ Although considerable effort has gone into overcoming the R&D heritage of the United States space community, the transformation is incomplete.

What Lessons Apply to the Future?

Before examining where senior military space leadership focused development efforts after the Gulf War, it is important to determine if the pursuit of a resolution is worthwhile. Pertinent to this question is the well-known analysis of World War I airpower “lessons” developed by I. B. Holley Jr. “These lessons are much the same as those which might have been derived equally well from the Civil War or, for that matter, from any other war. As was true of former conflicts, World War I emphasized the necessity for a conscious recognition of the need for both superior weapons and doctrines to ensure maximum exploitation of their full potential.”⁵⁵ In other words, wherever military leaders fail to emphasize the need for better weapons in lieu of more weapons, they usually suffer serious disadvantage. When military leaders fail to formulate doctrine to exploit innovative weapons, they suffer further disadvantages.⁵⁶ In terms of technological development, the analysis thus far highlights the need for space power leadership to develop a responsive launch capability for the United States, ensure war fighters retain the ability to acquire MSI, and develop a new system to provide theater ballistic missile warn-

ing. But equally important, this analysis suggests senior leadership should develop forward-looking space power doctrine to guide and educate war fighters.

In an era when space power is envisioned to perform many new missions with very limited resources, Dr. Holley's advice rings true. If the majority of the problems related to space power in the Gulf War fall into the categories of experience and doctrine, military leaders should be making every effort to formulate military doctrine to match the innovative space weapons. New doctrine will not only provide a direction for waging the next war, it can be used to train and educate war fighters on the applications space power can provide. Failing this, the nation may repeat the regretful pattern of the air weapon after World War I, recklessly groping forward with each technological innovation.⁵⁷ The salient question is, have US military leaders apportioned space power development efforts appropriately among technology, experience, and doctrine since the Gulf War?

Technology

Space power leadership is aggressively seeking resolution to the technological problems encountered in the Gulf War. In general, the senior leadership continues to expand R&D of new space technologies. For example, funding for TENCAP, which contains the major classified and unclassified Air Force technology projects, has increased by an order of magnitude. At the unclassified level, the budget for TENCAP is now \$35 million per year versus \$3 to 4 million prior to the Gulf War.⁵⁸ While resolution of the technological problems is far from complete, technology continues to receive an unbalanced portion of attention in the development of space power.

After the Gulf War, Air Force Space Command established the SWC to support combat operations through a variety of functions. One of its charters was to take the lessons learned in the Gulf War and apply them to day-to-day operations and wartime support.⁵⁹ Of note here is that TENCAP, well established prior to the Gulf War, dominates the SWC's functions and finances. After the war, TENCAP expanded its operation to leverage the billions of dollars spent on "national technical

means.”⁶⁰ The TENCAP system is organized using the previously classified code word *Talon* in six separate programs. The four principal technology divisions are command, control, communications, computers, and intelligence (C⁴I) (Talon Command); mission support (Talon Ready); force application (Talon Shooter); and special operations (Talon Night). Talon Touch and Talon Vision provide communications connectivity and processing power support to all the programs.⁶¹ These technology programs dominate the SWC’s day-to-day activities.

To normalize tactical warning support, the 11th Space Warning Squadron recently reached a milestone in theater missile warning. Its Attack and Launch Early Reporting to Theater (ALERT) system reached initial operating capability (IOC) on 10 March 1995.⁶² The ALERT program was developed following the Gulf War to find better ways of using the DSP satellites for theater ballistic missile defense.⁶³ The technology acquired to secure this capability under the Talon Shield program responds to some of the lessons illustrated earlier. The ALERT program is a technological attempt to normalize and improve tactical warning support to the war-fighting CINCs.

The lack of a responsive space launch capability is the subject of many studies and debates, but a decision addressing a long-term resolution to the problem is at least a year away.⁶⁴ This decision could result in an operational vehicle by 2005.⁶⁵ As described previously, the need for a responsive space launch capability in the United States was a significant lesson from the Gulf War. As a result, the fiscal year 1994 defense bill tasked the secretary of defense to provide a plan to improve the US launch capability. The result was Gen Thomas S. Moorman’s Space Launch Modernization Plan which, in turn, led to Presidential Decision Directive/NSTC 4, “National Space Transportation Policy,” issued on 5 August 1994.⁶⁶ The policy calls for a two-track effort. First, the short-term solution requires continued access to space by supporting and improving existing space launch capabilities—namely the space shuttle and current expendable launch vehicles (ELV). Second, the long-term goal is to pursue reliable and affordable access to space through focused

investments in, and orderly decisions on, technology development and demonstration for next-generation reusable transportation systems.⁶⁷ President Clinton assigned responsibility for the next-generation reusable technology development/demonstration program to the National Aeronautics and Space Administration (NASA).⁶⁸

To solve the problem of the United States's aging MSI and other national intelligence, surveillance, and reconnaissance (ISR) capabilities, USSPACECOM is working with the Office of the Secretary of Defense. MSI was extremely beneficial during Operation Desert Shield/Desert Storm providing US and Coalition forces the opportunity to better understand and react to changes in the terrain. It also offers future war fighters the ability to rehearse their missions, determine optimum tactics, and identify major threat lanes or attack axes to more effectively exploit training and technology in combat.⁶⁹ However, the failure of LANDSAT 6 coupled with the DOD decision to stop funding for LANDSAT 7 leaves the military dependent on the aging LANDSAT 5 and foreign sources, such as the French SPOT system, to satisfy MSI requirements.⁷⁰ In fact, during the Gulf War, we relied exclusively on the French for MSI requirements.⁷¹ The MSI working group has not resolved this issue but is committed to resolve the problem by the turn of the century.⁷²

Experience

After the Gulf War, several significant organizational fixes were geared to improve space power experience and to normalize space support to the theater commanders. To solve some of the major problems witnessed in the Gulf War, senior Air Force leaders created the Fourteenth Air Force, the SWC, the National Test Facility within the SWC, and the SST concept.

On 1 July 1993, the Air Force established Fourteenth Air Force as its operational space component to USSPACECOM to integrate space support for theater warfare, organize space support to theater operators, and to train/exercise with space systems.⁷³ For the first time, airpower leaders organized space power in a familiar manner to mirror the way the rest of the Air Force operated. Fourteenth Air Force is now responsible

for war planning, readiness, and execution. It serves as the war-fighting component to USSPACECOM for satellite control, missile warning, communications, navigation, space surveillance, and space launch operations.⁷⁴

Establishing Fourteenth Air Force was one piece of the organizational solution enacted to resolve the problems identified during the Gulf War. In December 1993, the Air Force conceived the Space Warfare Center. The SWC's charter is to refine doctrine, develop tactics, and formulate concepts and capabilities to better apply space for all war fighters. Integral to the SWC are the war-gaming and analytical capabilities embodied in the National Test Facility, also located at Shriever Air Force Base (AFB), Colorado. The National Test Facility is responsible for helping educate, train, and prepare war fighters for joint warfare by providing space scenarios for military exercises worldwide.⁷⁵ General Horner, then the CINC AF-SPACECOM, originally envisioned the SWC to be Air Force Space Command's version of Red Flag and the Air Corps Tactical School all under one roof. He saw a need for an organization to develop the "space tactics and doctrines" while developing prototype programs under the TENCAP program.⁷⁶ In reality, SWC personnel are developing many new space technology ideas but very little space power tactics and doctrine.

Air Force Space Command implemented the final organizational change by developing Air Force Space Support Teams (AFSST).⁷⁷ USSPACECOM service components and intelligence agencies followed with their version of this concept.⁷⁸ The AFSSTs will normally work with the joint force air component commander to provide space support.⁷⁹ At a minimum, SSTs from each of the three service components, USSPACECOM, and the National Reconnaissance Office (NRO) deploy to support all of the theater CINCs. War-fighting CINCs requested support from the SSTs in 20 exercises during 1994.⁸⁰ In a more recent exercise in South Korea, more than 15 separate SSTs deployed.⁸¹ Many agencies are now spring-loaded to support the war fighter, but without the aid of joint space doctrine to describe the relationship between the SSTs.⁸²

The Space Warfare Center is also conducting space courses for different levels of training. First, the Space Tactics School

(STS) completed its inaugural class in July of 1994.⁸³ This school (formerly the Space Tactics Instructor Course) was conceived by General Horner to give the career space and missile officers an avenue to improve their professional knowledge. In another attempt by General Horner to pattern space power after airpower, the STS was designed after the USAF Weapons School.⁸⁴ Its mission is to foster interagency “cross-pollination” so the best techniques and experiences can be transferred among the different elements of the space community.⁸⁵ The Air Force developed another training course for the Air Force Space Support Teams. This course is chartered to increase space power awareness and instruct personnel who assist the theater air component commanders and their staffs. Finally, a third space power training opportunity offers a three-to-four-day orientation course designed for audiences with broad backgrounds, including senior leadership.⁸⁶ All of these courses are attempts to increase space power experience and literacy.

Doctrine

War-fighting commanders and service components are developing doctrines to guide the use of space power in the next war. In spite of these steps forward, doctrine remains well behind the gait of space power’s technological development. With the help of USSPACECOM, Fourteenth Air Force, the SWC, and the service components, war-fighting CINCs have made progress in developing their individual OPLANs.⁸⁷ “Space Operations Doctrine” (AFDD-4) is nearing completion after years of coordination.⁸⁸ *Air Force Basic Doctrine* (AFDD 1) is in the early stages of a major revision and is probably several years away from completion. Finally, “Joint Space Doctrine” (Joint Pub 3-14) has been in the coordination process since before the Gulf War.⁸⁹

US Central Command OPLAN 1002-95. Prior to the Gulf War no doctrine was available to guide or educate USCENTCOM war fighters on space power. Since the war, USCENTCOM planners have incorporated a space power annex (annex N) in their OPLAN describing specific space assets available for future planning.⁹⁰ While not a replacement for basic or operational space doctrine, annex N to this OPLAN is

a small step in the right direction. Nevertheless it does not provide the guidance needed to maximize space power's robust capabilities.

Air Force Manual 1-1. The current version of AFM 1-1, March 1992, assumes the same basic doctrine that applies to airpower applies to space—"aerospace power."⁹¹ The next version of AFM 1-1, is expected to overturn this decision.⁹² The drafters of the new version expect to separate airpower and space power into distinct roles and missions. This separation is a complete reversal of policy provided to the authors of the 1992 version. Based on the recommendations of the "Blue Ribbon" Todd Commission on Space, the writers of the 1992 version of AFM 1-1 were instructed to totally integrate air and space.⁹³ The Air Force's indecision on integration of air and space is yet another reason why space doctrine continues to flounder. As outlined, the new version will take the position that space capabilities cannot be derived by simply applying the term *aerospace* to what is an otherwise comprehensive airpower doctrine.⁹⁴

Major Air Force commands will have an opportunity to include applicable space power experiences from the Gulf War into AFDD 1. It is difficult to predict when AFDD1 will appear, but if it follows the same pattern as its predecessor it may be years away from completion.⁹⁵ It is too soon for the authors of AFDD1 to predict how the space power experiences from the Gulf War will affect the new document.⁹⁶

AFDD 4. If approved as currently written, AFDD 4 offers a small doctrinal step for space command, but a huge leap for the military space community. This document has been in coordination since the Gulf War.⁹⁷ If AFDD 4 is approved as currently written, it will address many of the space power experiences from the Gulf War. For example, AFDD 4 describes command of space forces, roles and missions of space forces, space employment concepts, space power for the theater campaign, and education and training. All of these topics are directly related to the experiences of the Gulf War.⁹⁸

In fact, of the space power doctrinal documents examined in this study, the draft of AFDD 4 is the only reference with a general description of the relationship between the war-fighting CINCs and the space support teams.⁹⁹ Although the

current draft of AFDD 4 is a less robust version of previous drafts, it offers some relief in the doctrinal stalemate.

Joint Doctrine, Tactics, Techniques, and Procedures (JDTTP) 3-14, *Space Operations*. Arguably the most important doctrinal document, Joint Pub 3-14, is no closer to completion than it was four years ago. The Joint Chiefs of Staff issued the program directive for Joint Pub 3-14 on 30 March 1990. USSPACECOM initiated plans to distribute the first, fully coordinated version of Joint Pub 3-14 by May 1991.¹⁰⁰ Unfortunately, the publication is mired in the coordination process and will be rewritten prior to another coordination cycle.¹⁰¹

Joint Pub 3-14 is the most important doctrinal reference, not only because future operations are likely to be joint efforts but also because the chairman of the Joint Chiefs of Staff recently included a statement in all joint publications stipulating they will be followed except when in the judgment of the commander, exceptional circumstances warrant otherwise.¹⁰² This is especially important for joint space operations because of service, unified, and national space support teams augmenting the joint force commander's staff during war.

Space Power's Development after the Cold War

Efforts to address the problems encountered during the Gulf War are evident in all phases of the development of space power, but it is apparent that technological innovations still receive an unbalanced share of space power attention. The development of Air Force basic doctrine, Air Force operational space doctrine, and joint space doctrine is embarrassingly far behind innovative space technologies.

The disdain of space doctrine is a well-documented fact. In January 1988, Colin S. Gray made the following comment about space doctrine: "It has been 43 years since the first spacecraft was launched (Germany's V-2 rocket) and 30 years since Sputnik, yet today there is no doctrinal literature worth reading on the subject of battle field space."¹⁰³ Gray's statement is as accurate today as it was in 1988. Later, Lt Col Alan J. Parrington made similar comments in the *Airpower Journal*: "The United States has not decided what it wants to do in space, how it can achieve its aims, or

what equipment it needs for future space exploration. If the US government is to eliminate confusion and give direction to the space program, it must first develop a cohesive military spacedoctrine.”¹⁰⁴

Col Edward C. Mann III supports Parrington’s declaration by summarizing the short shrift many Air Force officers give Air Force basic doctrine in a recent publication, *Thunder and Lightning*: “Boring or not, when the popes (chief of staff), cardinals (four-star generals), and archbishops (three-star generals) disdain doctrine, the faithful will follow suit.”¹⁰⁵ Finally, Lt Col Steven J. Bruger describes the actions needed to prepare US space forces for the next space war. Bruger states, “The first need is a key element—development of space doctrine to provide guidance and direction at all levels of war, across the full spectrum of conflict.”¹⁰⁶ The development of space doctrine at all levels has been and continues to be the largest impediment facing the military space community today.

Conclusion

We need joint doctrine that clearly defines control and force application to support the evolution of space systems from a pure supporting role into a menu of joint space force options whose stated purpose is to ensure overall US space superiority.

—George Moore, Vic Budura, and Joan Johnson-Freese

Summary of Findings

The overwhelming majority of the documented lessons in the Gulf War concerned either a lack of doctrine or a lack of space literacy/ experience. The military space community is years away from internalizing these experiences. While the space community pursues ideas to normalize space power operations, doctrine is an afterthought—“dull, boring, and useless,” or “important but not read by warriors.”¹⁰⁷ Specifically, the lack of doctrine continues to impede efforts to maximize effective war fighting with space power assets. Less costly reforms in doctrine could offer more leverage for the future US military space program when combined with the existing space power tech-

nology. The synergy of improvements to AFDD 1, approval of AFDD 4, and the creation of joint space doctrine offers a cost-effective boost to the advancement of space power for the future. Gen Thomas S. Moorman Jr., vice chief of staff of the Air Force, feels that the complete internalization of space power lessons from the Gulf War is at least a generation of war fighters away.¹⁰⁸ More focus on doctrine can accelerate the internalization of recent space power experiences. The impact of redressing the imbalance existing in the development of space power makes the thesis of this study a prime consideration for the next logical step in future space power policy.

Primary Conclusions

1. The majority of space power lessons from the Gulf War resulted from a lack of doctrine and experience.
2. Technology remains the military space community's primary focus—doctrine and experience continue to lag well behind technology in the development of space power.
3. Space doctrine development is long overdue.
4. USSPACECOM did not have a formal process of monitoring the space power lessons after the Gulf War.¹⁰⁹
5. Space power advancement is still impeded by the cold war mentality and the extreme security requirements associated with this era.

Recommendations

The US space community should focus on redressing the imbalance among doctrine, experience, and technology in space power's development. Among the Gulf War lessons, the USSPACECOM exercise database, and the JULLS, sufficient historical information is available to help write useful space power doctrine. In particular, Joint Pub 3-14 is urgently needed to help guide the influx of space support teams in theater exercises. After approval, "Space Operations Doctrine" (AFDD 4) can potentially serve as an accurate guide for the rewrite of the space power portion of Air Force Basic Doctrine (AFDD 1). Finally, the US military space community is dangerously close to completely discarding forward thinking in space

doctrine. We must reverse this mind-set to ensure that doctrine guides the development and employment of future space systems.

The development of space doctrine and the liberation of the space community from the security restrictions of the cold war paradigm will spur education concerning the attributes of space power. All services will benefit from the development of space doctrine because it can serve as the basis for space power professional military education (PME). An aggressive space power PME program, from basic training to the senior service schools, is the only way to fully internalize space power lessons. In addition, a major step forward in educating the force and establishing core competency would tear down the walls of classification the military space intelligence community has built around itself. The United States will be better served by establishing a single military space sector with representation from all the services. The current ultra-secret intelligence space sector is very resilient but inefficient.¹¹⁰ In short, the United States should “give the warfighting CINCs more control over intelligence support.”¹¹¹

The integration of all military and intelligence space activities will not only increase the war-fighting CINC’s influence on space power support, it will help centralize the acquisition, control, and tasking of satellites. The military space community must continue to search for superior weapons and force multipliers—this is an essential requirement. However, current acquisition and management of national satellites are fragmented. The recent Report of the Commission on Roles and Missions of the Armed Forces supports this finding. The commission recommends that the secretary of defense integrate the management of military and intelligence space activities, assign the development of the integrated architecture of military space systems to a joint service office, and designate the Air Force as the primary (not sole) agency for acquisition and operation of multiuser space-based systems.¹¹² These changes will make the already aggressive development of space power technology much more efficient.

Notes

1. Many authors reference the Gulf War as the “first space war”; however, since we have used space assets in warfare since Vietnam, it seems more appropriate to call Operation Desert Storm the “first information war.” This is the first time a war revealed just what impact information management can have. James A. Winnefeld, Preston Niblack, and Dana J. Johnson, *A League of Airmen: US Airpower in the Gulf War* (Santa Monica, Calif.: RAND, Project Air Force, 1994), 4, 181–84.

2. In AFM 1-1, space power is defined as “that portion of aerospace power that exploits the space environment for the enhancement of terrestrial forces and for the projection of combat power to, in, and from space to influence terrestrial conflict.” This definition originated in a draft to AFM 2-25 which no longer exists. Another definition is found in the current draft of AFDD 4: “Spacepower is the capability to exploit civil, commercial, intelligence, and national security space systems and associated infrastructure to support national security strategy and national objectives from peacetime through combat operations.” This study uses the AFDD 4 definition. Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force*, vol. 2, March 1992, 300. AFDD 4, “Space Operations Doctrine,” draft, 1 May 1995, 3.

3. Many of the reports analyzed for this thesis use the words *strategic* and *tactical* to differentiate between missions to support the nuclear deterrence strategy of the United States and other than nuclear missions respectively. *Strategic* and *tactical* are more appropriately used in terms of levels of war or effects during war. For a useful definition, see Col John Warden, *The Air Campaign* (New York: Pergamon-Brassey’s, 1989), 2–3.

4. Lt Col Mike Wolfert, address to the Space Issues Team on Roles and Missions, Washington, D.C., 14 November 1994, slide S2-OVER 3.

5. *Gulf War Air Power Survey*, vol. 4, “Weapons, Tactics, and Training and Space Operations” (Washington, D.C.: Department of the Air Force, 1993), 169. (Hereafter cited as *GWAPS*.)

6. Gen Merrill A. McPeak, address during the SPACE TALK ‘94 Briefing, 16 September 1994.

7. USSPACECOM, *Operation Desert Shield and Desert Storm Assessment* (U) (Peterson AFB, Colo.: USSPACECOM, 31 January 1992), 65–67 (Secret/NoForn); and *US Central Command After Action Report, Operation Desert Shield/Storm* (U) (MacDill AFB, Fla.: USCENCOM, 15 July 1991), 37–47 (Secret/NoForn). Information extracted from both reports is unclassified. (Hereafter cited as USSPACECOM after action report [AAR] and USCENCOM AAR.)

8. Joint Doctrine, Tactics, Techniques, and Procedures (JDTTP) 3-14, *Space Operations*, 15 April 1992, V1-5.

9. Lt Gen Thomas S. Moorman Jr., “Space Acquisition Conference Remarks,” 27 May 1994, 2.

10. At the most recent Joint Space Doctrine working group meeting, USSPACECOM/J5, Maj William Doyle stated that Joint Pub 3-14 will be

rewritten. He projected the document to be in final coordination 12 to 14 months from this meeting. Maj William Doyle, "Joint Space Doctrine Working Group," Peterson AFB, Colo., 31 May–1 June 1995.

11. Moorman, 7.

12. This concept was adopted from Col Dennis M. Drew, USAF, Retired. Colonel Drew presented this framework on 2 May 1995 during the School of Advanced Airpower Studies Course 680—Airpower Theory II. For a similar framework see Mackubin Thomas Owens, "Lessons of the Gulf War," *Strategic Review*, Winter 1992, 51.

13. A useful definition comes from James W. Canan in "Normalizing Space," *Air Force Magazine*, August 1990, 12. Canan defines *normalizing* as follows: "This means launching and operating its space systems as matter-of-factly and purposefully as it does its aircraft and treating those systems as workaday and warfighting tools, not as showpieces in the sky." I would add "acclimating the cold war space culture into everyday operational life." USSPACECOM AAR, 65.

14. USCENTCOM OPLAN 1002-90, United States Air Force Historical Research Agency, Maxwell AFB, Ala.

15. Lt Gen Thomas S. Moorman, "Remarks to the Eighth National Space Symposium," Colorado Springs, Colo., 2 April 1992, 1.

16. Ibid.

17. Gen Charles A. Horner, "Space Seen as Challenge, Military's Final Frontier," *Defense Issues* 8, no. 34 (22 April 1993): 1.

18. USSPACECOM AAR, 67.

19. Ibid.

20. "Joint Universal Lessons Learned System (JULLS) Database" (U) on CD-ROM, Navy Tactical Information Compendium (NTIC) (Washington, D.C.: Department of the Navy, December 1994), disk 2, JULLS 92659-18177 (Secret/NoForn). Information extracted is unclassified. Also, *Conduct of the Persian Gulf War: Final Report to Congress*, vols. 1 and 2 (Washington, D.C.: Department of Defense, April 1992), K 50-51. (Hereafter cited as the CPGW.)

21. Moorman, "Space Acquisition Conference Remarks," 4.

22. USCENTCOM AAR, 37.

23. Ibid.

24. Michael M. Garrell, *There Are No Space Wars, How Do CINC's Fight Using Space Forces?* (Newport, R.I.: Naval War College, 17 June 1994), 17. Garrell argues that it is clear from the postwar analysis that the successful use of space power was due largely to innovation, creativity, and ad hoc procedures, not operational thinking.

25. JULLS 31538-21500.

26. USSPACECOM Joint Space Support Team (JSST) Briefing, USSPACECOM/J33S, undated, slide J3-1-30-10.

27. JULLS 50352-59445 and 91747-98856.

28. Lt Col Steven J. Bruger, "Not Ready for the First Space War, What about the Second?" *Naval War College Review* 18, no. 1 (Winter 1995): 76. Also, *CPGW*, K 31.

29. JULLS 15242-11100.

30. Ibid.

31. Ibid., 50612-8818.

32. *GWAPS*, v.

33. Ibid.

34. Ibid., v-vi.

35. Ibid., vi.

36. Ibid.

37. *CPGW*, ix and K 50.

38. Ibid., K 49.

39. Ibid., K 48, 49.

40. Ibid., K 48.

41. Lt Col Robert E. Miller, chief of USSPACECOM's Joint Training and Simulation Section, interview by author, 1 June 1995.

42. USSPACECOM AAR, Attachment 2.

43. Mark G. Cooney, JCS Evaluation and Analysis Division, interview by author, 1 May 1995. For a detailed description of the JULLS process, see CJCS Instruction 5716.01, 1 October 1994, B-1.

44. Ibid.

45. Gen Charles A. Horner, interview by author, 28 April 1995.

46. Ibid.

47. Ibid.

48. Owens, 51.

49. For an enlightening view of doctrine, see Col Dennis M. Drew, "Of Trees and Leaves: A New View of Doctrine," *Air University Review*, January-February 1982, 40-48.

50. Lt Gen Thomas S. Moorman, "Creating Tomorrow's Space Forces," speech to the San Francisco Commonwealth Club, San Francisco, Calif., 1 December 1993.

51. The writers of the Wilkening Report include Laurel L. Wilkening, appointed by President Ronald Reagan in 1985 as vice chairman of the National Commission on Space; Lt Gen James A. Abrahamson, USAF, Retired, first director of the Strategic Defense Initiative; Edward C. "Pete" Aldridge, former secretary of the Air Force; Joseph P. Allen, former astronaut with NASA; Daniel J. Fink, with over 40 years aerospace engineering experience; John S. Foster Jr., former director of Lawrence Livermore National Laboratory; Edward Frieman, former director of Energy Research with the Department of Energy (DOE); Don Fuqua, served 12 terms as a US congressman; Gen Donald J. Kutyna, USAF, Retired, former commander of NORAD and AF Space Command; John M. Logsdon, author of *The Decision to Go to the Moon: Project Apollo and the National Interest*; and Bruce C. Murray, former director of NASA/California Institute of Technology Jet Propulsion Laboratory. *A Post Cold War Assessment of US Space Policy; A Task*

Group Report (Washington, D.C.: Department of Defense, 17 December 1992), appendix 11. (Hereafter cited as the Wilkening Report.)

52. Wilkening Report, 23.

53. Lt Col Mike Wolfert, chief of Air Force Space Command Strategy, Policy, and Doctrine, interview by author, 1 June 1995.

54. Lt Gen Thomas S. Moorman, "Public Affairs Background for Query Response," 30 June 1993. Effective date of the transfer was 1 July 1993.

55. I. B. Holley Jr., *Ideas and Weapons* (Washington, D.C.: Office of Air Force History, 1983), 175.

56. *Ibid.*, 175–76.

57. *Ibid.*, 178.

58. Maj Joe Squatrino, Space Issues Committee, Air Force Roles and Missions, interview by author, 15 May 1995.

59. Lt Col Kip Hunter, "TALON Programs Overview," *Space Tactics Bulletin* 1, no. 1 (June 1994): 5.

60. Col Mike Francisco, "SWC Support to Warfighters," *Space Tactics Bulletin* 1, no. 1 (June 1994): 3.

61. Hunter, 5.

62. Capt John Kennedy, "Theater Missile Warning Unit Reaches Operations Milestone," *The Guardian*, April 1995, 13. Also see Sean D. McClung, "TALON SHIELD Declares Victory!" *Space Tactics Bulletin* 2, no. 1 (November 1994): 3.

63. Kennedy, 13.

64. *Space Launch Modernization Study* (Washington, D.C.: Department of Defense, 18 April 1994), 17–19.

65. *NASA Implementation Plan for the National Space Transportation Policy*, 7 November 1994, 13.

66. *Ibid.*, 3.

67. *Ibid.*

68. *Ibid.*

69. Moorman, "Space Acquisition Conference Remarks," 4.

70. Horner, "Testimony before the Senate Armed Services Committee," March 1994, 25.

71. Wolfert interview.

72. *Ibid.*

73. Moorman, "Space Acquisition Conference Remarks," 2.

74. *Ibid.*

75. Lt Gen Thomas S. Moorman, "Presentation to the Committee on Appropriations, Subcommittee on Defense, US House of Representatives," Washington, D.C., March 1994, 5.

76. Moorman, presentation to the House, 5–6.

77. AFDD 4, 10.

78. Gen Joseph W. Ashy, commander in chief, USSPACECOM, "Orlando Air Force Association," speech, Orlando, Fla., undated, 6.

79. *Ibid.*

80. USSPACECOM JSST briefing, slide J3-1-30-12.

81. Wolfert interview.
82. Maj William Doyle, Joint Space Doctrine Working Group, Joint Pub 3-14 Working Group, USSPACECOM/J5X, Peterson AFB, Colo., 31 May–1 June 1995.
83. Lt Col Dan Chapman, "Space Tactics School (STS) Completes Inaugural Class," *Space Tactics Bulletin* 2, no. 1 (November 1994): 4–5; Capt David Koster, "Space Training—Coming Soon to a Theater Near You!" *Space Tactics Bulletin* 2, no. 1 (November 1994): 5–6.
84. Chapman, 4.
85. Ibid.
86. Brig Gen David L. Vesely, "Commanders Corner," *Space Tactics Bulletin* 2, no. 1 (November 1994): 1.
87. Horner interview.
88. Wolfert interview.
89. Joint Space Doctrine Working Group.
90. Moorman, "Space Acquisition Conference Remarks," 4. USCENTCOM OPLAN 1002-95, undated, submitted on 1 June 1993. This OPLAN was never approved. Annex N is a general list of capabilities but does not provide guidance on how to use space power to fight the next war.
91. AFM 1-1, vol. 1, 5.
92. AFDD 1, outline chap. 3.
93. Col Dennis M. Drew, USAF, Retired, project team chief and principal author of the 1992 version of AFM 1-1, interview by author, June 1995.
94. Col Kenneth A. Myers and Lt Col John G. Tockston, "Real Tenets of Military Space Doctrine," *Airpower Journal*, Winter 1988, 55. Also, see Maj Grover E. Myers, "Aerospace Doctrine We're Not There Yet," *Air University Review*, September–October 1986, 91–99.
95. AFM 1-1, vol. 1, i. The time period between the latest two versions of AFM 1-1 was eight years and two months. If the next version follows the same pattern, AFDD 1 will be available at the turn of the century.
96. AFDD 1, outline. Also, Mr. Wayne R. Williamson, principal author of AFDD 1, Air Force Doctrine Center, interview by author, 15 June 1995.
97. Wolfert interview.
98. Ibid.
99. AFDD 4, 8–10. Also, Joint Space Doctrine Working Group.
100. Joint Chiefs of Staff Program Directive for Joint Pub 3-14, Message date time group, 301638Z March 1990, Washington, D.C., 1.
101. Joint Space Doctrine Working Group.
102. It is also important to note that "if conflicts arise between the contents of this publication and the contents of Service publications, this publication (Joint Pub 3-14) will take precedence for the activities of joint forces." Joint Pub 3-14, ii. It is the opinion of this author that the doctrinal community as a whole has taken these statements as license to avoid development of forward-looking doctrine. During the most recent Joint Space Doctrine Working Group, all service representatives indicated that their senior leadership has interpreted these "directive" statements to mean

that doctrine cannot include futuristic guidance. If a space mission (force application) is not possible today because of politics or funding, it should not be described in any doctrinal publication. This thinking is a step backward in doctrinal development, especially for space-based assets. Space power's operational potential will be maximized in the future. The Gulf War is only a glimpse of what the United States will benefit from robust space power capabilities.

103. Colin S. Gray, "Space Warfare: Part I, the Need for Doctrine," *National Defense*, January 1988, 25.

104. Lt Col Alan J. Parrington, "US Space Doctrine: Time for a Change?" *Airpower Journal*, Fall 1989, 51.

105. Col Edward C. Mann III, *Thunder and Lightning: Desert Storm and the Airpower Debates* (Maxwell AFB, Ala.: Air University Press, 1995), 164–65. Also see Colonel Mann's description on page 181: "As such, war is subject to all the vagaries of the human mind, spirit, and will. So long as this is true, ideas, concepts, philosophies, and doctrines will always matter."

106. Bruger, 79.

107. Mann, 164.

108. Gen Thomas S. Moorman Jr., vice chief of staff of the Air Force, interview by author, Maxwell AFB, Ala., 5 June 1995. I agree with General Moorman that until Air Force personnel can communicate the importance of space power from the ranking general officer to the basic airman, and until we have space power advocates or heroes (as we did with airpower), only then will we fully internalize the lessons from the war.

109. Recently, USSPACECOM instituted a program to monitor lessons from any exercise to which the joint space support teams deploy. USSPACECOM will monitor all lessons from these exercises and will submit significant findings to the Joint Chiefs of Staff for inclusion in the Joint Universal Lessons Learned System. Miller interview.

110. Reports indicate that the ultrasecret space programs are likely to remain tightly veiled, especially in the National Reconnaissance Office. James M. Gifford, "New Clinton Policy Aims to Reduce Government Secrecy," *Space News*, April 24–30 1995, 14.

111. "Directions for Defense; Report of the Commission on Roles and Missions of the Armed Forces" (Arlington, Va.: Commission on Roles and Missions of the Armed Forces, 1995), 2-6, 2-7.

112. *Ibid.*, 2-7.

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